

CLAIMS:

1. An optical flow estimation method comprising the steps of:
 - (a) obtaining encoded image data representative of an image sequence of a changing object having a motion field;
 - (b) extracting from said encoded image data first frame data blocks not incorporating motion vector encoding;
 - (c) extracting from said encoded image data second frame data blocks incorporating motion vector encoding;
 - (d) determining from said first frame data blocks confidence map data indicative of the edge strength within said encoded image data and hence the accuracy of the motion field;
 - (e) deriving from said second frame data blocks smooth motion field data blocks in which each data block has a single motion vector and the magnitudes of the motion vectors are normalised; and
 - (f) updating the confidence map data on the basis of the smooth motion field data blocks to provide output data indicative of the optical flow of the image.
2. A method according to Claim 1, wherein the encoded image data is MPEG-2 encoded video data.
3. A method according to Claim 1 or 2, wherein the first frame data blocks are representative of luminance data of said encoded image data.
4. A method according to Claim 3, wherein the first frame data blocks extracted from said encoded image data are representative of a discrete cosine transform (DCT) of the luminance data.
5. A method according to Claim 4, wherein the confidence map data is determined from weighted AC coefficients of the discrete cosine transform (DCT) representative of the intensity gradients in mutually transverse directions.

6. A method according to Claims 1 and 4, wherein the confidence map data is determined from the weighted AC[1] and AC[8] coefficients of the MPEG-2 encoded video data representative of the intensity gradients in mutually transverse directions.
7. A method according to Claim 4 or 5, wherein the confidence map data is determined from the sum of the squares of the weighted AC coefficients of the discrete cosine transform (DCT) representative of the intensity gradients in mutually transverse directions.
8. A method according to any one of Claims 1 to 7, wherein the smooth motion field data blocks are derived from said second frame data blocks by a transformation in which, where a second frame data block has no motion vector, the corresponding field data block is ascribed the same motion vector as the immediately preceding field data block.
9. A method according to any one of Claims 1 to 8, wherein the smooth motion field data blocks are derived from said second frame data blocks by a transformation in which, where a second frame data block has two motion vectors pointing in opposite directions, the corresponding field data block is ascribed a motion vector in one of the directions having a magnitude corresponding to the sum of the magnitudes of said two motion vectors pointing in opposite directions.
10. A method according to any one of Claims 1 to 9, wherein the smooth motion field data blocks are derived from said second frame data blocks using spatial filtering to suppress isolated smooth motion field data blocks having a low probability of reflecting real movement.
11. A method according to any one of Claims 1 to 10, wherein the confidence map data is updated when the vector of a smooth motion field data block has a magnitude exceeding a certain threshold.

12. An optical flow estimation system utilising encoded image data representative of an image sequence of a changing object having a motion field, the system comprising:

- (a) first extraction means for extracting from said encoded image data first frame data blocks not incorporating motion vector encoding;
- (b) second extraction means for extracting from said encoded image data second frame data blocks incorporating motion vector encoding;
- (c) determination means for determining from said first frame data blocks confidence map data indicative of the edge strength within said encoded image data and hence the accuracy of the motion field;
- (d) derivation means for deriving from said second frame data blocks smooth motion field data blocks in which each data block has a single motion vector and the magnitudes of the motion vectors are normalised; and
- (e) updating means for updating said confidence map data on the basis of said smooth motion field data blocks to provide output data indicative of the optical flow of the image.

13. A system according to Claim 12, which is adapted to receive MPEG-2 encoded video data.

14. A system according to Claim 12 or 13, wherein the first frame data blocks are representative of luminance data of said encoded image data.

15. A system according to Claim 14, wherein the first extraction means is arranged to extract the first frame data blocks such that the first frame data blocks are representative of a discrete cosine transform (DCT) of the luminance data.

16. A system according to Claim 15, wherein the determination means is arranged to determine the confidence map data from weighted AC coefficients of the discrete cosine transform (DCT) representative of the intensity gradients in mutually transverse directions.

17. A system according to Claims 13 and 16, wherein the determination means is arranged to determine the confidence map data from the weighted AC[1] and AC[8] coefficients of the MPEG-2 encoded video data representative of the intensity gradients in mutually transverse directions.

18. A system according to Claim 16 or 17, wherein the determination means is arranged to determine the confidence map data from the sum of the squares of the weighted AC coefficients of the discrete cosine transform (DCT) representative of the intensity gradients in mutually transverse directions.

19. A system according to any one of Claims 12 to 18, wherein the derivation means is arranged to derive the smooth motion field data blocks from said second frame data blocks by a transformation in which, where a second frame data block has no motion vector, the corresponding field data block is ascribed the same motion vector as the immediately preceding field data block.

20. A system according to any one of Claims 12 to 19, wherein the derivation means is arranged to derive the smooth motion field data blocks from said second frame data blocks by a transformation in which, where a second frame data block has two motion vectors pointing in opposite directions, the corresponding field data block is ascribed a motion vector in one of the directions having a magnitude corresponding to the sum of the magnitudes of said two motion vectors pointing in opposite directions.

21. A system according to any one of Claims 12 to 20, wherein the derivation means is arranged to derive the smooth motion field data blocks from said second frame data blocks using spatial filtering to suppress isolated smooth motion field data blocks having a low probability of reflecting real movement.

22. A system according to any one of Claims 12 to 21, incorporating a digital processor.

23. A computer readable recording medium on which is recorded an optical flow estimation program for causing a computer to execute the following steps:

- (a) extracting, from encoded image data representative of an image sequence of a changing object having a motion field, first frame data blocks not incorporating motion vector encoding;
- (b) extracting from said encoded image data second frame data blocks incorporating motion vector encoding;
- (c) determining from said first frame data blocks confidence map data indicative of the edge strength within said encoded image data and hence the accuracy of the motion field;
- (d) deriving from said second frame data blocks smooth motion field data blocks in which each data block has a single motion vector and the magnitudes of the motion vectors are normalised; and
- (e) updating the confidence map data on the basis of the smooth motion field data blocks to provide output data indicative of the optical flow of the image.